EEO316: Integrated Electronic Devices and Circuits I

Fall 2013

2013-2014 Catalog Description:

This is an advance undergraduate circuit design course that will discuss the principles, concepts and techniques required to produce successful designs of analog integrated circuits. Fundamentals of devices, circuits and basic topologies will be reviewed. Topics considered will include design of high-performance operational amplifiers and comparators. (3 credits)

Course Designation: Technical Elective

Text Book: D.A. Johns and K. Martin, "Analog Integrated Circuit Design", 2nd edition, Wiley 2011.

Prerequisites: EEO271

Instructor: **Milutin Stanaćević**

Goals: The purpose of this course is to introduce students to principles of analysis and design of analog integrated circuits, starting from single transistor circuits to the multi-stage operational amplifier design.

Objectives: Students should be able to: 1) analyze and design single-stage amplifier, 2) analyze and design multi-stage differential amplifiers, 3) analyze the frequency response of a single-stage and multi-stage amplifier, 4) design a high-gain amplifier based on defined set of performance parameters.

Topics Covered:

Week 1.	Introduction to analog integrated circuits, analog IC design flow.
Week 2.	Fundamentals of pn junction, MOS transistor and passive devices.
Week 3.	Modeling of MOS transistor. Large and small signal model. Two-port amplifier analysis.
Week 4.	Single-stage amplifiers: common-source amplifier and common-source amplifier with source degeneration.
Week 5.	Single-stage amplifiers: common-drain and common-gate amplifier.
Week 6.	Current sources and mirrors.

Week 7.	Cascoded current sources and mirrors. *Midterm exam.*
Week 8.	Cascode and folded-cascode amplifiers.
Week 9.	Differential Pair. Single-ended output differential amplifier. Fully differential amplifier.
Week 10.	Operational amplifiers. Two-stage operational amplifier.
Week 11.	Cascode and folded-cascode single stage differential amplifiers.
Week 12.	Frequency response. MOS capacitances and AC model of MOS transistor.
Week 13.	Frequency response of single-stage amplifiers.
Week 14.	Stability and compensation of operational amplifiers.

Class/laboratory Schedule: 3 lecture hours per week.

Program Outcomes and Assessment	**% contribution***
✓ (a) an ability to apply knowledge of mathematics, science and engineering	40
❑ (b1) an ability to design and conduct experiments	
❑ (b2) an ability to analyze and interpret data	
❑ (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
❑ (d) an ability to function on multi-disciplinary teams	
✓ (e) an ability to identify, formulate, and solve engineering problems	30
❑ (f) an understanding of professional and ethical responsibility	
✓ (g) an ability to communicate effectively	5
❑ (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
❑ (i) a recognition of the need for, and an ability to engage in life-long learning	
❑ (j) a knowledge of contemporary issues	
✓ (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	20
❑ Any other outcomes and assessments?	5
✓ (l) an ability to communicate and/or collaborate effectively online	

* Assume that the total contribution of any course will be 100%. Use the right hand column to indicate the approximate percent that the left hand columns contribute to the overall course.

Document Prepared by: Milutin Stanaćević on 2/8/2014